National Ocean Service
Electronic Mail System Improvement Team

E-mail Architecture Baseline Characterization

August 1998

Executive Summary

The National Ocean Service (NOS) Electronic Mail System Improvement Project Team was formed to review the existing electronic mail environment in NOS, develop solutions for current problems, and develop an architecture for a future NOS e-mail system. Systems Architecture principles are used to ensure the team work is carried out according to an appropriate organizational and technical context. The first task was to develop the E-mail Architecture Framework Document. The second task is to review the existing e-mail systems in NOS and produce this document, the E-mail Architecture Baseline Characterization Document.

This E-mail Architecture Baseline Characterization Document describes the functionality, the infrastructure, and some of the operating procedures of the NOS e-mail systems. Existing hardware/software systems are listed and diagramed, e-mail use is described, and systems management is discussed. This document is used as a reference document for the project.

Some findings from the Baseline Characterization include:

1. NOS operates 20 e-mail servers comprised of 11 different types of user software and eight types of e-mail server software. These systems are typically operated as autonomous mail servers connected to the Internet, and updating the NOAA Mail*Hub directory according to their own schedules.
2. NOS does not have focal point for e-mail technical leadership, advice, or coordination.
3. E-mail administration is not a full-time activity for any NOS staff member. Most perform these duties as an adjunct activity.
4. There is one business process, HAZMAT spill reporting, that currently requires the special features of a proprietary mail system.
5. Existing Banyan, QuarterDeck, cc:Mail, and DEC e-mail systems are near the end of their useful life and need to be replaced as soon as possible.

The next steps in the Electronic Mail System Improvement Project are to define requirements, choose standards, and develop the high level design for the Target Architecture. Following that a Migration Plan will be written for a staged implementation of the Target Architecture.

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Introduction

The purpose of this E-mail Architecture Baseline Characterization Document is to describe the current e-mail environment in NOS and to understand the current systems as they operate currently. This baseline will be used as a reference to aid in the identification of requirements and standards during the target architecture development phase. The baseline will also be used as input to the migration options phase as a reference to help identify the sequence and timing of implementation of the target architecture.

Following Systems Architecture principles, this document presents a general description of the current e-mail environment not the details of all the systems. A minimum survey was conducted of the number and types of e-mail systems in place, capabilities of these systems, and the geographic dispersion of the NOS staff were reviewed. This information is valuable in developing a shared understanding by e-mail team members of the current state of operations; e-mail system capabilities that support business functions; and how e-mail systems decisions have been made in the past.

This document has two sections, the current system description, and a second section on implications of the current e-mail system environment. The current e-mail system description is further divided into a series of views. The functional view describes the user or operational perspective, the technical view provides a review of the infrastructure, and the systems view considers technical planning, staffing, and geographic distribution.

The second section of this document highlights the implications of the observations in the current system description that should be considered in later stages of this project. Constraints are included to describe matters related to the development of this document.

Current System Description

The following sections describe the existing NOS e-mail systems that are in use as of the Summer of 1998. Functional, technical, and system views are provided below. The functional view is a users view and considers e-mail features in use, business processes, and e-mail usage habits. The technical view describes the e-mail server/network infrastructure, life-cycle, and diagram. The system view describes technical leadership, advice, coordination, staffing, and geographic distribution issues.

Functional View

The purpose for collecting and analyzing this information is to understand our current e-mail status from a users view. This view is described below.

Features of current e-mail systems

E-mail features were defined in Table 1, E-mail Feature Definitions. All the features were considered as useful, those marked with an asterisk essential for current operations.

Table 1. E-mail Feature Definitions

Feature	Definition
* Attachment Viewer	The ability to view the contents of an attachment and at a minimum, print the contents.
Auto Reply	The ability to send an 'out of office' message at a minimum.
Bulletin Board	Ability to read/post shared message(s) that are not threaded.
*Calendar	An integrated proprietary solution which includes groupware scheduling and corporate calendar.
HTML in body	The client capability to display html (web based) formatted messages. This includes web links, links to e-mail addresses, and formatting of text to name a few.
IMAP4 Shared Folders	Directories/folders that can have privileges assigned to them and their contents.
*News Groups	The ability to read/post shared message(s) with threaded capability.
* Offline/Online	The ability to compose message(s) prior to connecting or working with messages on the mail server. Provides the capability of allowing the user to decide if they want to download a particular message to their machine knowing that it has a large attachment.
* Personal Address Book	The addition of users and groups to the client e-mail package. An alternative to this is a list server with open registration.
* Personal Archives	The client can store messages off the server and maintain their own backup of messages.
* Return Receipt	The ability to know that a message has been delivered to an individual.
Rules	The ability to run processes on a mailbox. An example of a process would be to copy all messages from a particular user or with a particular title to an archive.
* Spell Check	The client capability to verify spelling within a message.

NOS systems were reviewed to understand which features are used by the NOS staff. In the table below, the implemented features are indicated. This table does not detail the available features of the commercial e-mail software, only the features that are implemented and used by the organizations using these systems.

Table 2. Currently Used E-mail Features

NOS Organization	AA, MB, ORCA	IPO, MB, OCRM	NCCOS, NCOP	NCCOS GLERL	NCCOS GLERL	NCCOS GLERL	NCCOS GLERL	NCCOS Beaufort	NGS	NCCOS Charleston	OCS	OCS	ORCA/SEA	CSC	HAZMAT	DAC	OPSD	OPSD
	Banyan Beyond	Quarterdeck 4.2	Lotus Notes	MS-Outlook	Elm	Eudora	Netscape 4.0	Banyan Blue Mail	Eudora	cc:Mail	Banyan Blue	Banyan Beyond Mail	cc:Mail	Eudora Pro 4.0	First Class 3.5	MS-Outlook	Pathworks	MS -IE 3.0 & 4.0
Attachment Viewer			x	x		x	x		x	x		x	x		x			x
Auto Reply		x	x						x				x			x		
Bulletin Board										x			x		x	x		
Calendar		x	x							x			x			x		
HTML in body			x	x		x	x		x	x				x				x
IMAP4 Shared Folders																x		
News Groups			x	x			x								x	x		x
Offline/Online		x	x	x		x	x			x				x	x	x	x	x
Personal Address Book	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Personal Archives		x	x	x	x	x	x		x	x	x			x		x	x	x
Return Receipt	x	x	x			x		x	x	x	x	x	x	x	x	x		
Rules	x	x	x	x		x	x		x	x		x	x	x		x		x
Spell Check	x	x	x	x		x	x		x	x		x	x	x	x	x		x

E-mail systems with more features in use tend to be more modern than those with fewer features. Several systems have many attributes beyond this feature set. Some features that were considered in this review were not specifically e-mail features for example, news groups, bulletin boards and calendars. They were considered because they are frequently offered with e-mail systems, they enhance the communication and teamwork for some staff, and were considered

important in the context of this study. Analysis of the current systems and their use supports the following findings:

1. Incompatible proprietary features that are used in group work (e.g., return receipt, bulletin boards, news groups, calendar) causes confusion among the users and reduces communication and teamwork.
2. Older systems don't provide all essential features and should be replaced.
3. The incompatible non-standard systems should be weighed against Staff/Program Office autonomy of choice in those systems.
4. Several NOS e-mail implementations do not offer some features available in the client software. Examples of this are group calendar, server-based rules, and return-receipt.
5. Spell check, Personal Address Book, and Personal Archives are essential features to include in any future system.

E-mail Enabled Business Processes

For the most part, NOS does not depend upon the specific proprietary features of commercial e-mail systems. NOS typically relies on features that are common to all e-mail systems. Examples of these include one-to-one communication such as a message sent from one staff member to another, and one-to-many e-mail messaging such as a message sent to a list of several people. Other one-to-many e-mail processes include receiving all-hands messages, or sending messages to remote NOS staff, NOAA staff, and non-federal partners and constituents.

A description of various categories of use is presented in Appendix A. There are six categories of use described including 1) general individual communication, 2) general group communication, 3) calendar/schedule processes, 4) general business processes, 5) systems control / administration, and 6) business processes tightly coupled to proprietary e-mail system features. All categories of use can be supported by most current mail systems except the last category. NOS has only one business process that is highly dependent on specific features of a proprietary e-mail system, the HAZMAT Division. When an oil or hazardous chemical spill occurs, Division staff track spill events using a bulletin board in the First Class mail system. This system allows information to be shared with authorized users. There are approximately 600 users that are non-NOS and only about 100 that are NOS users. The operation of this system is vital to oil spill response activities. Although the HAZMAT system has some weaknesses, NOS should consider the current operations before recommending any changes to this system which would reduce its functionality.

E-mail and Messaging Use Categories are presented in Appendix A. Analysis of the current e-mail features and their use supports the following findings:

1. Offices with needs for only routine one-to-one, and one-to-many e-mail features can adapt to most of the available e-mail systems on the market.
2. Only one NOS business process (HAZMAT Oil Spill information sharing) is bound tightly with the proprietary features of an e-mail system. All other business processes of

NOS could be migrated to a common system with minimal impact.
3. Choices for existing e-mail systems other than the HAZMAT use of First Class were not based on a specific business process-enabling features.

E-mail Use, Habits, Cultural Tendencies, Training, and Support

Although usage of e-mail in NOS is substantial, with nearly all staff having access to an e-mail account, there may be some cultural tendencies or usage habits that exist that should be addressed in the Systems Architecture process. These tendencies could be caused by incompatible systems, but will only be reversed through awareness.

1. Typically, when a message is sent to a group of people, replies are addressed only to the originator. The addressed group misses out on the dialog between the respondent and the originator.
2. All Hands e-mail lists are not completely automated, and are therefore not 100% reliable. This may cause many people to be uninformed on organization-wide information.
3. Because of incompatible systems, there is no commonly available mailing list capability. This inhibits group e-mail use.
4. NOS has no policy on e-mail training for users, or dissemination of best-practices information.
5. NOS has no common source for information that users need about the e-mail system.
6. NOS e-mail users continue to have problems with attachments.

Technical View

The technical view below considers the existing e-mail systems, their life-cycle, a technology assessment of the systems, and a diagram of the mail system.

Current E-mail Systems in NOS

NOS operates 20 mail servers. There are nine different types of e-mail servers in use and seven different types are operated on the SSMC campus. NOS operates 7 Banyan, 4 Sendmail, 2 Quarterdeck, 2 cc:Mail, and one each of Worldmail, Dec, MS Exchange, Firstclass, and Lotus Notes. Client software that is in use includes Banyan Beyond Mail, Banyan Blue mail, Quarter Deck, First Class, NetScape, Lotus Notes, Eudora, Internet Explorer/Outlook, cc:Mail, MailTool, and several varieties of UNIX mail software (ELM, PINE, etc.). (See Appendix C.)

1. NOS operates 20 mail servers of 9 different varieties with little formal coordination or communication between server administrators. This lack of cohesion effects our purchase negotiating position, and our collective technical expertise in e-mail, and causes confusion among users.
2. The Banyan system uses a third party add-on gateway for SMTP support. Experience

with products that use third party SMTP support suggests that SMTP support should be provided as a native capability of a mail system, not an add-on from a third-party vendor, to ensure that SMTP translation is done properly, and that the prime network software vendor is fully accountable for supporting SMTP.
3. There is no agreed upon standard for the encoding of attachments. Most systems use MIME, but some systems do not have this capability.
4. NOS does not have any policy or procedure that coordinates the work of systems administrators and ensures that e-mail problems are resolved quickly.

Directory Services

In the past, NOS offices used Banyan mail, but recently many of these Banyan users have moved away from the Banyan e-mail system. An important feature of the Banyan e-mail system is its directory service which provided the convenience of maintaining user names, nicknames, and mail lists, as well as network resources such as printer and file services. Although the Banyan directory is still maintained, NOAA/OFA is now focusing its resources on the X.500 Mail*Hub. The Mail*Hub is a reliable and valuable directory for user names, but does not provide the type of mail lists for NOS that were easily established and administered in the Banyan system. NOAA/OFA has emphasized the Mail*Hub as more important technology than of Banyan. Additionally, NOAA/OFA has moved their own mail system from Banyan to Netscape, using a custom directory synchronization with the X.500 directory.

1. Less than half of NOS staff uses the NOAA - Banyan directory.
2. The NOAA-Banyan directory is becoming less utilized as a NOAA/NOS business asset, and is being replaced by the NOAA-X.500 directory. However, the X.500 directory does not replace the Banyan capability for mail lists, or file and print services.
3. There is currently no common mailing list service or general group communication tool in use by NOS.
4. The NOAA X.500 is more accessible (via WWW and LDAP)than the NOAA - Banyan directory.
5. NOS has no policy on updating the NOAA X.500 e-mail directory for e-mail systems other than Banyan.

Life-cycle and Technology Assessment of Current E-mail Systems

A discussion at one of the E-mail Engineering Working Group meetings was held to determine where their e-mail system was in its useful life, and whether their system should be replaced soon. Banyan, Dec, QuarterDeck, and cc:Mail administrators believed their systems had reached the end of their useful life and should be replaced shortly.

A technology assessment of e-mail systems that addresses life-cycle issues is presented in Appendix D. This assessment demonstrates how administrators perceive the existing e-mail systems. The current e-mail systems were evaluated with respect to important features. The client and server software were evaluated separately. The worksheets for this analysis are provided in Appendix D. In the analysis, a score of one (1) was given each feature supported by the current system. The Preliminary Score is the sum of the feature scores. The final score is the product of the Preliminary Score and the Organizational Replacement Factor. Both the client and server Technical Merit tables and additional explanation is provided in Appendix D. This assessment supports the following findings:

1. NOS Banyan, cc:Mail, QuarterDeck, and DEC have reached the end of their life cycle. These have little potential to continue on as corporate mail systems.
2. Other systems including First Class, Exchange, Notes, SMTP systems (e.g., Netscape or Eudora in combination with SMTP servers) may be in the middle of their life cycle and may be considered as viable interim e-mail systems for some currently undetermined period. These systems should be reviewed during the Target Architecture phase and the Migration/Implementation phase to determine their overall relevance to a corporate mail system.
3. Client software that are considered of merit include MS Internet Explorer, Netscape, Eudora, MS Outlook, First Class, and Notes.
4. Server software that is considered of merit includes Sendmail (all varieties), Exchange, Notes, and First Class.
5. Most software that are planned for replacement (Banyan, QuarterDeck, cc:Mail, DEC) have low technical merit.

System Diagram

A system diagram of NOS e-mail systems is presented in Appendix E. This is a logical diagram that indicates the mail systems, how they connect to the Internet, and how they perform directory synchronization with the NOAA Mail*Hub. This diagram also indicates the DOC/NOAA Banyan network. Of note in this diagram is that only two of the systems receive automatic directory updates from the NOAA Mail*Hub.

System View

The system view presented here considers how the mail systems in NOS interoperate and other items that are not captured by the Functional or Technical view. These items include technical leadership and coordination, staffing, problems, and geographic distribution.

Technical Leadership, Advice, and Coordination

In the past, NOS left the operation of e-mail systems largely up to the Program and Staff offices as a matter of philosophy. NOS did not provide resources to operate the e-mail systems as an integrated resource. Under the leadership of Dr. Foster priorities have changed, resulting in the LMI study and the establishment of the E-mail System Improvement Team. The following findings describe some of the duties that are not currently accomplished and should be addressed:

1. Currently, there is no one person who monitors all NOS entries in the X.500 mail system to ensure that:
   - all NOS names are entered in the NOAA X.500 directory;
   - directory updates occur properly from all mail systems;
   - and, mail names are linked up with the correct personal information in the NOAA Locator.
2. Currently, no source exists to provide technical advice on e-mail operation for NOS system administrators including:
   - NOS internal e-mail matters;
   - system upgrades, migration, replacements, and troubleshooting;
   - NOS-wide system administration procedural matters;
   - maintenance of a Knowledge Base including emergency systems administration point-of-contact information, technical advisories and plans, and user support;
   - and, external (non-NOS) e-mail problems and resolution including gateway, routing, encoding, attachment, performance, network, and encryption problems.
3. Currently, there is no source of technical leadership in NOS to provide:
   - e-mail system planning;
   - evaluation and advice on evolving standards and technologies;
   - research on new product releases and implementation;
   - and, evaluation and recommendations on new procedures and practices in NOS e-mail use and administration.
4. Decisions on e-mail are currently made by Program and Staff Offices or their Divisions without much coordination. Some NOS Program Offices are running different mail systems in each division. Some offices are faced with the task of communicating across three or more dissimilar e-mail systems. This causes disruption for some staff members particularly those involved in cross-cutting teamwork.

NOS Input to NOAA Directory Maintenance Processes

Policy, procedure, and coordination of the Banyan system has historically been lead by NOAA and DOC. There was limited formal policy guidance for Banyan system administrators, and most of the guidance was informal coordination between administrators. New administrators joining the system generally had to learn much of the informal practices through trial and error, leading to some system failures and other undesirable consequences. Many organizations migrated away from the Banyan system to other systems and are now relying on the X.500 directory. Oversight and NOS input to the operation of the X.500 directory is minimal. However, a forum is being created by the NOAA Resource Development Center to receive input from NOAA Line Offices which may result in improved policy and coordination. One observation from this situation is that NOS will need to work with NOAA to develop polices that ensure good operation of the X.500 Mail*Hub.

Staffing

The following is observed about the current staffing of e-mail functions in NOS:

1. No one in NOS has e-mail administration as a full-time job. E-mail administration is generally a collateral duty of technical staff assigned to server or network administration. Technical staff has designed and implemented systems to minimize administrative workload and coordination instead of a system that works as a NOS-wide corporate system.
2. There is no current staffing for technical leadership and coordination described above in NOS.

Geographic Distribution

NOS has a distributed organization. While most staff work on the Silver Spring Metro Center (SSMC) campus in Maryland, many work in field offices of various size. Additionally there are many NOS staff members located in small offices or co-located in non-NOS facilities that require e-mail services. This geographic distribution is included in the Baseline Characterization because it has substantive influence on the design and operation of an organizational e-mail system. Related to the geographic distribution is the need for remote access for NOS staff that travel, work at home, telecommute, or have other stationary/mobile e-mail access requirements. These needs are related because some of the technology that supports them is similar. The following table indicates an estimate of the number of NOS e-mail accounts supported at various locations. This is based on information collected from the Human Resource Data System (HRDS) and supplemented with information from e-mail administrators. This estimate is rough, as information on the number of NOAA Corp officers, contractors, other Federal, and non-Federal accounts were difficult to verify. Not included in this table are many NOS staff that work in offices smaller than 6 staff in the field. These are not included in this table, but are not overlooked by the study.

Table 3. Location of NOS Staff								
Location / Office	AA	OCRM	ORCA	OCS	NGS	Other NOAA	Non NOS	Total
Silver Spring	57	82	140	256	169	37		741
Charleston, CSC	23					10	70	103
Charleston, CCEHBR						100		100
Seattle	1		55	31	1		600	688
Norfolk				27	53			80
Beaufort						98		98
Ann Arbor						55		55
Chesapeake				20				20
Oxford						15		15

Target Architecture Design Implications

The preceding section described the existing system and pointed out some of the observations about the way it operates. The following design implications are a result of analyzing the baseline. These should be addressed in the Target Architecture development, or the Migration/Implementation Plan.

Functional Implications

1. A set of essential features that users must have in an e-mail system was identified. They are defined in Table 1 and include the following: Attachment Viewer, Calendar, Encryption, News Groups, Online/Offline operation, Personal Address Book, Personal Archives, Return Receipt, Spell Check.
2. The HAZMAT use of First Class is the only NOS business process that requires the continued use of a proprietary e-mail system. The HAZMAT process may be migrated to a more standards-based system in the future, however extensive planning is required to ensure that there is no serious disruption of spill operations. There are no other NOS business processes identified that require a particular e-mail system.
3. Although the NOAA Mail*Hub X.500 directory is providing a highly reliable directory service for NOAA and NOS, it has not provided the mail list function of the Banyan system that is required for a corporate mail system.
4. NOS QuarterDeck mail systems currently maintain a directory of Non-NOAA e-mail names. QuarterDeck users find this essential for their work.

Technical Implications

1. Approximately half of the NOS e-mail users are using obsolete systems which are at or near the end of their life cycle and should be replaced. Of the systems that are technically viable, several should be migrated to the target system to increase electronic communication for their staff members.
2. NOS operates too many different e-mail systems. Offices that are operating two or more systems should strongly consider migrating to a single e-mail system as soon as possible to reduce the complexity of the e-mail environment.
3. Multipurpose Internet Mail Extensions (MIME) is the most popular attachment encoding scheme used for Internet e-mail. Systems that do not handle MIME encoded attachments should be abandoned or fixed immediately.
4. For systems that will remain operational for an indefinite interim period, procedures must be documented that describe certain system administration processes. This documentation will ensure that these e-mail systems work as part of an increasingly unified whole.
5. E-mail Security issues were not reviewed as part of the baseline. It is planned that the security requirements will be documented as part of the Target Architecture. Systems

that remain operational on an undetermined interim basis will need to undergo a thorough security evaluation.
6. NOS must find a suitable directory service if the Banyan directory is to be abandoned.

System Implications

1. The Target Architecture and Migration/Implementation Plan should define technical leadership and coordination processes first identified as principles in the Architecture Framework document.
2. The Target Architecture should address staffing questions raised in this document and the LMI report. E-mail system design and support issues should be included in this discussion.
3. The Target Architecture should emphasize directory services as a key aspect of an e-mail system. Special attention must be paid to user support as well as directory maintenance.
4. The Target Architecture should consider the geographic distribution and remote access requirements of NOS staff in the overall system design and support.

Constraints of the Baseline Characterization

As indicated in the Executive Summary of this document, the analysis conducted for this study was not exhaustive, but insight into the current environment has been achieved.

Beyond the scope of this study are current infrastructure issues- for example, the average configuration of client computer workstation, network technology including access speeds and methods, and any preference for NT or UNIX servers was not studied in detail. This information could be useful in a baseline characterization, but was not collected because it can be determined later in the process with minimum effort.

Additionally, information on the individual e-mail accounts for one-person remote users was not collected as part of this document. Many of these one-person remote users use America On-Line (AOL), CompuServe, or another commercial provider. An assumption was made that these users are receiving adequate e-mail services considering their location and needs. Requirements for remote/mobile users are included in the overall project. Requirements of these two types of users will be considered as part of the overall project.

It is possible that not all NOS e-mail systems were identified in this study. The addition of one or two more systems would not significancy change the findings of this study.

Appendix A. E-mail / Messaging Use Categories

This list is intended to illustrate the use of e-mail. It divides the use into six categories and is arranged from generic individual use to specific mission-oriented use. The purpose is to describe how e-mail is used in NOS, and to help in identifying uses of e-mail that require special treatment in terms of identifying requirements or in migrating from one mail system to another.

E-mail / Messaging Use Table	
1) General Individual Communication	
Individual users require sending, forwarding, and replying functions from their e-mail systems. These functions are the basic functions, and are found in most e-mail systems.	
Receiving e-mail	Simple receipt of e-mail with or without attachments and being able to easily read the message and the attachment regardless of the size or format of the attachment.
Sending e-mail	Sending messages with or without attachments to one or more individually addressed people (not mail lists) regardless of the size of the attachments.
Forwarding e-mail	Sending a received message with or without attachments to one or more individually addressed persons (not mail lists).
Replying to e-mail	Sending a response (generally without the attachment(s)) to an e-mail to one or more persons that are automatically addressed by the e-mail system.
2) General Group Communication	
Features beyond the basic sending, forwarding, and replying, are used in groups to enable one-to-many communications so that all may benefit. These services are generally provided by a common server technology.	
Mailing Lists	Using a mailing list service that uses a single address to represent multiple addresses, and delivers the message to each member of the mailing list. Mail Lists support e-mail-based discussion where users send messages to a central address, and from there its distributed to all the list-members. Replies to an e-mail message go to the list so it can become a group conversation. Groups may be formed by divisions within an office, or for certain tasks/projects. Recipients are generally specifically included in the mailing list.
Broadcast bulletins/announcements	These are usually "broadcast" messages to the entire user community. These can be similar to official memos, or a more informal message to keep users in the loop. Recipients are generally in a category that is recognized by a server such as *@* in Banyan or all the members of a group on another server.
Bulletin Boards	Messages that start out as e-mail, and end up as e-mail in a publically accessible folder. The folders may be secured via password or other technique.
News Groups	Similar to Bulletin Boards, but the messages can be “threaded” where messages that refer to one another are linked.
Clipping or List Service	A service provided wherein a recipient subscribes to the service and receives a periodic e-mail.

3) General Calendar / Schedule Processes	
Individual Calendar / Scheduler	A personal calendar feature that enables an individual to keep their own calendar. Individual calendar / schedules are sometimes included in a Personal Information Manager (PIM) software suite. These do not allow one user to look at others schedules or to try to schedule group events by checking for free time.
Group Calendar / Scheduler	This feature supports group scheduling by enabling a user to check for free time of the others in a group. This feature requires a server to operate as a central calendar store for all users calendars. Additionally, several security levels are incorporated to enable various access rights to individuals that are allowed to access another's calendar.
4) General Business Processes	
Organizations have used the generic capability of e-mail to facilitate business processes. Below are a few of the common business processes that have used e-mail	
Help Desk	E-mail to and from a user and system administrator regarding problems with the user's system. Sometimes several people receive the same e-mail help requests generated by the help desk clients.
Webmaster Mailbox	Web pages often solicit comments or accept input from their readers. The addressee of these comments or input is generally to the Webmaster although it could be another name or personal address.
E-mail to a beeper	A web page has a fill-in script for a user to enter a return-call phone number for someone with a beeper. When the return-call number is filled in, the web page sends an e-mail to the beeper service provider, and the return-call phone number is sent to the person with the beeper. This method keeps the beeper number confidential.
5) Systems Control / Administrations Processes	
Automated triggers	These are e-mail messages that are automatically generated by a system to inform a user of a condition that needs attention. For example: failed logon attempts, out of disk space error messages, and messages regarding UNIX processes.
Automated File Download and Process Initiation	An e-mail message is received by a server. In the body of the message is an address for a file. The server automatically logs onto the location addressed in the file, downloads the file, and starts a process.
6) Businesses Processes Tightly Coupled to Proprietary E-mail System Features	
HAZMAT	The HAZMAT organization uses the First Class mail system's mail folders to share information on oil spills with approximately 100 NOS and 600 non-NOS users. The information must be available immediately to those involved in spills. Additionally, the information on this system must be maintained because it is used in litigation that follows after a spill occurs.

Appendix B. Identified Concerns

The following task list is composed of short-term actions that will solve some problems that have been identified in team discussions and recommendations made in the LMI study. These are all recommended tasks that can be accomplished now to improve the current Email environment.

1. Improve Directory Services
    - A. Develop a policy on timely updating and synchronization
    - B. Utilize the NOAA Mail*Hub services to the fullest extent possible
        1. Setup LDAP where client capability exists
        2. Train users to use LDAP
        3. Set "home" in browser to jump to X.500 or X.500 site or bookmark
        4. Teach users to cut/paste from browser to email client (Ctrl-C / Ctrl-V)
        5. Establish updates to X.500 for sites that are not yet providing updates

2. Improve Email Administration and Support
    - A. Develop a Standard Operations Procedure for Administrators
        1. Include standards for gateway configuration
        2. Include an archival policy
        3. Include a Check in/Checkout procedure
        4. Include a directory services administration procedure
        5. Include a problem resolution hierarchy and administrator name list
    - B. Develop an Email Use Policy
        1. Include a Check in/Checkout procedure for users
        2. Identify capacity limitations
        3. List server participation (i.e. when to go "nomail")
        4. Suggested etiquette
        5. Distinguish between formal and informal uses
        6. Identify methods for remote access
        7. Provide a problem reporting procedure
        8. Include an attachment handling guideline
    - C. Develop a training policy

3. Improve Knowledge Base
    - A. Publish a web accessible knowledge base for users and administrators
        1. Include a list of administrators and backup administrators
        2. Include an Email System Diagram
        3. Include a FAQ
        4. Include a link to the NOAA Web-based X.500 and locator services
        5. Include a method to receive feedback from the users
        6. Include the Email Use Policy
        7. Publish current information concerning email access or updates etc
        8. Announce to all of NOS

4. Improve Attachment Handling
    - A. Establish an FTP site for large attachments
    - B. Establish a service for users to request attachment conversion or decoding

Appendix C. Current E-mail Systems Listing

Many e-mail systems are currently operated by NOS. A synopsis is provide below, followed by a more detailed listing.

AA/MB	Banyan, QuarterDeck
CSC	Eudora / Worldmail
OPSD	Internet explorer / Sendmail, DEC
ORCA	
HQ	Banyan, Quarterdeck
SEA	cc:Mail
DAC	Exchange / Outlook
CMBAD	Banyan
HAZMAT	First Class
NGS	Sendmail / Netscape, Eudora, MailTool, Other Unix
OCS	Banyan
OCRM	Banyan, QuarterDeck
COP	Notes
Beaufort	Banyan, Sendmail / Netscape
Charleston	cc:Mail
GLERL	Sendmail / Netscape, Eudora

NOS Current Email Systems Listing

OFFICE	AA/MB	NOS/AA	CSC	OPSD	OPSD
Org Code	N/MB4	N/MBr	Nx33	N/CS45	N/CS45
City	silver Spring	Silver Spring	Charleston	Silver Spring	Silver Spring
State	MD	MD	SC	MD	MD
Admin Name	Fred Walton	Lawrence Charters	Mike Warren	Geoffrey French	Geoffrey French
Admin Phone #	(301) 502-7443	713-1156	843-740-1214	713-2806	713-2806
Backup Name	Rich Kissel	Terry Augustus	Robert Wilhite	Janet Burton	Janet Burton
Backup Phone #	(301) 713-1156	713-1080	843-740-1261	713-2806	713-2806
SERVER					
Wan Connection	campus5	NOS	T1 to Campus 8 SS	NOS	NOS
Server Name	MBserver1,2,3,4	ocean.nos.noaa.gov	mailsrv.csc.noaa.gov	140.90.155.20-ceob-g30	140.90.157.100/wlnet
Primary IP Gateway	NOAA Mail*Hub	ocean.nos.noaa.gov	none; native SMTP	140.90.155.1	140.90.157.1
Secondary IP Gateway	gw@adp@n	linus.ngs.noaa.gov	mh.rdc.noaa.gov; spur		
Mail Server Software	Banyan IM III	Quarterdeck Mail 4.2	WorldMail 2.0	HP POP server sw, v9.0	TCPWare POP v5.1
Secondary Software	n/a		Sendmail 8.8.1	HP Unix Mail Util, v9.0	Digital Open-VMS v6.1
Gateway Software	Mail*Hub, Incognito	QD SMTP Gateway 3.0	none		
OS Software	Vines 5.54(20),6.30(0)	Mac OS 7.6.1, 8.0(GW)	MS NT4.0; SP3	HP Unix, v9,0	Dig., Alpha Open-vms v6.1
Hardware	2*486s, 2*pentiums	PowerMac 7200/120	Gateway 2000; E-3110	HP 9000	Dig. Alpha 2100
DNS	NOC … 140.90.148.33	140.90.148.33, 148.34	csc.noaa.gov	nos.noaa.gov	nos.noaa.gov
Y2K Compliant	no	yes	yes	yes	yes
CLIENTS					
Client Software	BeyondMail, Blue Mail	Quarterdeck 3.6, 4.1,4.2	Qualcomm, Eudora Pro	IE, v3.0.2 and 4.0	IE v3.0.2 & 4.0
Access Method	local and remote	Appletalk over 10bT&PPP	POP3; IMAP4; ras	local	local
OPERATIONS					
Directory Service Type	STDA, x.500	Quarterdeck Mail	x.500	n/a	n/a
# names locally	50	50	100	47	40
Synch w/mailhub freq.	nightly		at any local user change	n/a	n/a
Directory Synch	automated	autow/sanc., Mont.,	manual	n/a	yes, noaa home page
X.500 utilization	secondary	no	x.500	yes, manually	yes manually
OTHER					
Additn'l E-mail Systems		One SMTP gateway		user mail comes & goes from HP	see previous
Special config info		machine, ocean. Four	secondary DNS's are	Users can log into HP or UNIX	
COMMENTS		server machines, Ocean	NOAA regional servers	Mail Util to read mail or use IE	
		Sanctuaries CINMS, and		Mail stored on HP. No file size	
		MBNMS		restrict'ns. No max mail mssges	
				Would like policy to remain.	

Appendix C. NOS E-mail Baseline Characterization

NOS Current Email Systems Listing

OFFICE	SEAD	NGS	OCS	OCRM	OCRM
Org Code	N/ORCA	N/NGS	NCS		
City	Silver Spring	Silver Spring	Silver Spring	Silver Spring	Silver Spring
State	MD	MD	MD	MD	MD
Admin Name	Russ Perry	G. Adams	Lara Petze	Terry Augustus	Terry Augustus
Admin Phone #	7133000x134	713-3251 x143	713-1910	713-1080	713-1080
Backup Name	Mike Shelby	Noel Tominack	David Floyd	Ahmad Fraz Ahmad	Lawrence Charters
Backup Phone #	7133000x203	713-3263 x181	713-1910	713-3155 x202	713-1156
SERVER					
Wan Connection	NOS	NOS	NOS	NOS	NOS
Server Name	seamail.nos.noaa.gov	dancer	NCG2Server1,2,3,4,5	OCRM1	tarpon.nos.noaa.gov
Primary IP Gateway	140.90.161.99		140.90.126.10,.2,.3,.4.,.5	140.90.167.1	ocean.nos.noaa.gov
Secondary IP Gateway	none		m@h@c	140.90.166.1	linus.ngs.noaa.gov
Mail Server Software	cc:mail r.8	sm 8.8.5 pop imap	Vines 6.40	Banyan IM III	Quarterdeck Mail 4.2
Secondary Software	ccweb r.8		Vines 6.40	VINES 5.54.(20)	
Gateway Software	cc:mail STMP link r.8		Vines 6.40, BeyondMail		QD SMTP Gateway 3.0
OS Software	Netware v4	SunOS 4.1.4	Vines 6.40	VINES 5.54.(20)	Mac OS 7.6.1
Hardware	Compaq Proliant P133	Sun Sparc 1+	Compaq Proliant 2000	Compaq Proliant	PowerMac 6100/66
DNS	140.90.148.33	ngs.noaa.gov	140.90.125.14	140.90.148.33	140.90.148.33, 148.34
Y2K Compliant		probably	no	no	yes
CLIENTS					
Client Software	cc:mail v8; cc:mail v6.1	Eudora, Netscape	Bluemail, Beyond Mail	Beyond Mail	Quarterdeck 3.6, 4.1,4.2
Access Method	local&remote		LAN	LAN	Appletalk over 10bT&PPP
OPERATIONS					
Directory Service Type	internal cc:mail DS	None	STDA	STDA	Quarterdeck Mail
# names locally	79	185	250	125	141
Synch w/mailhub freq.	administrator decision	None		n/a	
Directory Synch	manual		auto	auto	autow/sanc., Mont.,
X.500 utilization	yes; manually	Local to user	secondary, auto	secondary, auto	no
OTHER					
Additn'l E-mail Systems	seaserver.nos.noaa.gov				One SMTP gateway
Special config info	used for MRH.				machine, ocean. Four
COMMENTS	Netscape web server for	NGS would have no			server machines, Ocean
	cc:web on internet. Secondry	heartache using an			Sanctuaries CINMS, and
	server uses 486/66; Astrix.	NOS mail server if it was			MBNMS
	No sense in using OS sw.	fast, accessible & reliable			

Appendix C. NOS E-mail Baseline Characterization

NOS Current Email Systems Listing

OFFICE	ORCA	ORCA-DAC	ORR	COP	NCCOS
Org Code	N/ORCA; N/ORR	NOS/DAC	NOS/N/ORCA3	N/COP (NCCOS-HQ)	GLERL
City	Silver Spring	Silver Spring	Seattle	Silver Spring	Ann Arbor
State	MD	MD	WA	MD	MI
Admin Name	Carl Muller	Karl Mueller	Philip Gruccio	Timothy Morris	John Fenton
Admin Phone #	7132989 x131	713-2989 x131	206-526-3444	301-713-3338	734-741-2127
Backup Name	Gus Gamarra	Gus Gamarra	Nicole Scillo	Tony Bulman	Glenn Muhr
Backup Phone #	7133038 x203	713-3038 x203	206-526-6558	301-713-3338	734-741-2127
SERVER					
Wan Connection	NOS	NOS	via Sand Point BB	NESDIS	ISP-Merit NW (U of MI)
Server Name	Orca_Server (Banyan)	exchange.nos.noaa.gov	Hazmat Info Server	copnt.cop.noaa.gov	glerl.noaa/192.94.173.87
Primary IP Gateway	n/a	exchange.nos.noaa.gov	161.55.66.2	140.90.236.1	192.94.173.1
Secondary IP Gateway	n/a		none	none	none
Mail Server Software	Banyan Vines 5.54 (20)	MS Exchange 5.5	SoftArc FirstClass v3.5	Lotus Domino/Notes 4.6.1	UNIX senmail v.8.7.1
Secondary Software	none		n/a	n/a	none
Gateway Software	none		SoftArc FC GW v1.0	Lotus Domino SMTPTA	none
OS Software	n/a	MS Windows NT 4.0; SP3	Mac OS8.1 on FC Server	Windows NT 4.0;SP3	HP-UX 9.0.5
Hardware	Dell 466DE	GW 2000, pent. 133/64ram	Mac Quadra 800/700	Compaq Prosignia 500	HP-725
DNS	use NOC	140.90.148.33, 156.11	via Sand Point BB		192.94.173.87
Y2K Compliant	no	no	yes	none	yes, after HP-UX 10.20 upgrade
CLIENTS					
Client Software	Banyan Mail Client-Mac	MS Exch. Outlook, IE, Qualcomn	SoftArc FirstClass	Lotus Notes 4.6.1, Netscape	Netscape 4.0
Access Method	local and remote	local/remote	local	Local/remote	yes
OPERATIONS					
Directory Service Type	STDA	X.500	FC-local x.500-rest	local via LDAP	X.500 from Mailhub
# names locally	40	35	100	35	55
Synch w/mailhub freq.	n/a	Monthly	n/a		only when modified
Directory Synch	auto	manual	n/a	manual	manual
X.500 utilization	no	yes, manually	secondary/auto	secondary; manually	manual
OTHER					
Additn'l E-mail Systems			NOAA Hazmat-	Server IP: 140.90.236.254	Also use clients: Elm,
Special config info			Seattle 24 hr #		MS-Outlook, MS-Internet
COMMENTS			2065266317		Mail, & Eudora
			Sever IP: 161.55.66.3		
			GW OS:Mac OS		
			7.5.5 on FC GW		

Appendix C. NOS E-mail Baseline Characterization

NOS Current Email Systems Listing

OFFICE	CEHBR	NCCOS	NCCOS	NCCOS	NCCOS
Org Code	NS400	CCFHR	CCFHR	CCFHR	CCFHR
City	Charleston	Beaufort	Beaufort	Beaufort	Beaufort
State	SC	NC	NC	NC	NC
Admin Name	Carl Kinerd	Charles Krouse	Linda Matthews	Linda Matthews	Linda Matthews
Admin Phone #	843-762-8557	252-728-8773	252-728-8773	252-728-8773	252-728-8773
Backup Name	Lewis LaCoss	Linda Matthews	Charles Krouse	Charles Krouse	Charles Krouse
Backup Phone #	843-762-8580	252-728-8775	252-728-8775	252-728-8775	252-728-8775
SERVER					
Wan Connection	NOS	T1 via Duke U.	NMFS to Oxford MD	NMFS to Oxford, MD	NMFS
Server Name	NMFS-CHS	cwatch.bea.nmfs.gov	atlantic.bea.nmfs.gov	hatteras.bea.nfms.gov	oxford.bea.nmfs.gov
Primary IP Gateway	NOAA Mailhub	cwatch & Mailhub	hatteras & mailhub	hatteras & mailhub	hatteras & mailhub
Secondary IP Gateway	kingmack.chbr.noaa.gov				
Mail Server Software	Lotus cc:mail v.8.1	sendmail (linux)	Banyan IM III	Banyan IM III	Banyan IM III
Secondary Software	UNIX SMTP		Banyan IM III	Banyan IM III	Banyan IM III
Gateway Software	NOAA Mailhub	POP3, SMTP		Incognito SMTP	Incognito SMTP
OS Software	Novell 4.10	Linux 5	Banyan Vines 7.10(0)	Banyan Vines 5.54 (20	Banyan Vines 7.10(0)
Hardware	Insight Pent	Micron Millenium	Compaq Proliant 4500	Compaq Proliant 2000	DELL
DNS	chbr.noaa.gov	192.154.39.242 (DU)	192.154.39.242 (DU)	192.154.39.242 (DU)	
Y2K Compliant	not yet	none	none	none	none
CLIENTS					
Client Software	cc:Mail	Pine, Netscape	Banyan Mail IM III	Banyan Mail IM III	Banyan Mail IM III
Access Method	remote and local	Pine Netscape	DOS, WIN, no RAS	DOS, WIN, no RAS	DOS, WIN, no RAS
OPERATIONS					
Directory Service Type	NMFS cc:Mail	STDA, x.500 via web	STDA satellite	STDA Host	STDA satellite
# names locally	100	10	50	50	25
Synch w/mailhub freq.	Daily via cc:mail	N/A	N/A	n/a	n/a
Directory Synch	auto	none	none w/mailhub	none w/mailhub	none w/mailhub
X.500 utilization	yes via cc:mail; second	manually via FTP	manually via FTP	manually via FTP	manually via FTP
OTHER					
Additn'l E-mail Systems	DOS w/modem;cc:mail		mail forward to different	mail forward to different	mail forward to different
Special config info			POP3 for RAS	POP3 server for RAS	POP3 for RAS
COMMENTS	suggestion made to keep #				Support turnover to
	# user/admin to <=40. Suggest				Charleston in future
	not using cc:mail. Access via				
	POP3, IMAP4 & Web if P.O. on NT				

Appendix C. NOS E-mail Baseline Characterization

Appendix D. Technology Assessment

Terminology Reference for the Technology Assessment	
Addbook	Address book. E-mail client feature allowing users to keep email address of personal interest or create nicknames for long email addresses.
BinHex	An encoding scheme that converts binary data into ASCII characters. E-mail programs can include a BinHex encoder and decoder for sending and receiving attachments. BinHex is common for Macintosh Files
Client	An application that runs on a personal computer or workstation for sending, receiving and organizing email. In the client-server architecture, it is the software that users work with.
Dirsynch-auto	A directory service which synchronizes the mail server directory with the NOAA x.500 directory without administrative intervention.
Encrypt.	Encryption. The translation of data into a secrete code. Encryption is the most effective way to achieve data security. To read an encrypted file, you must have access to a secret key or password that enables you to decrypt it.
HTML	Acronym for Hyper Text Markup Language. The e-mail system can display HTML documents as the body of a message.
IMAP4	Acronym for Internet Message Access Protocol version 4. An e-mail remote access protocol that allows messages to be stored on the server and selectively downloaded to a client computer.
LDAP	Acronym for Lightweight Directory Access Protocol. E-mail client software supports LDAP for accessing and searching directories including the NOAA X.500 directory.
Life cycle	The period of time that technology is considered useful to an organization. As technology ages, its use decreases, and is considered at the end of its life cycle.
Local Dir	A network service that identifies network resources e.g., e-mail names, shared list of external users, and printers, and makes them available to network users.
M/B/U	Indicates having MIME, BinHex, or Uuencode message attachment schemes.
Native SMTP	The server uses SMTP services that came with the server software from its original developer, as opposed to having SMTP services provided from a third party company. (see SMTP)
Off/Online	Offline and Online. The e-mail system client software works while connected to the server, or disconnected so that remote users can pick up email, then disconnect to read/reply to the mail.
P/I/L	Having POP3, IMAP4, or LDAP features
POP3	Acronym for Post Office Protocol. A remote access e-mail protocol that does not allow messages to be selectively be stored on a mail server.
Post Office	A server based collection of electronic post office boxes where e-mail is sent and collected
Spell chk	Spell check feature are included in the e-mail client.
SMTP	Acronym for Simple Mail Transfer Protocol. SMTP is the most common e-mail protocol in use on the Internet for sending messages from one mail server to another.
Uuencode	A set of algorithms for converting files into a series of 7-bit ASCII characters that can be transmitted over the Internet as an attachment to an e-mail message.
V/P Att	View and Print attachments. The e-mail client software includes a viewer that will recognize a wide variety of attachments and display them on a screen, and print them on a printer in a readable representation regardless of whether the application software is loaded on the computer.
X.500	A hierarchal directory with different levels for each category of information, such as country, state, and city.

NOS E-mail Technology Assessment

						Technical Merit								
Clients			**Feature Set**											
Office	***Post Office***	***Client***	*LifeCycle*	*Off/Online*	*Encryp.*	*P/I/L*	*M/B/U*	*V/P Att*	*Addbook*	*Spell chk*	*HTML*	**Prelim. Score**	**Org Replace?**	**Final Score**
AA/MB	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
AA/MB	Banyan	Beyond	0	0	0	0	1	1	1	1	1	5	0	0
MB/IPO	Quaraterdeck	Quarterdeck	0	1	0	1	3	0	1	1	0	7	0	0
CSC	Worldmail	Eudora	1	1	0	3	3	0	1	1	1	11	0	0
CO-OPS	P Unixmail	IE	1	1	1	1	1	1	1	1	1	9	1	**9**
CO-OPS	Digital Open	IE	1	1	1	1	1	1	1	1	1	9	1	**9**
SPO	cc:Mail	cc:Mail	0	1	1	0	3	1	1	1	1	9	0	0
NGS	Sendmail	Netscape	1	1	1	3	1	0	1	1	1	10	1	**10**
NGS	Sendmail	Eudora	1	1	1	2	3	1	1	1	1	12	1	**12**
NGS	Sendmail	mailtool	1	0	0	1	1	0	0	0	0	3	1	3
NGS	Sendmail	elm, pine,etc.	1	0	0	1	1	0	0	0	0	3	1	3
OCS	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
OCS	Banyan	Beyond	0	0	0	0	1	1	1	1	1	5	0	0
OCRM	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
OCRM	Banyan	Beyond	0	0	0	0	1	1	1	1	1	5	0	0
OCRM	Quarterdeck	Quarterdeck	0	1	0	1	3	0	1	1	0	7	0	0
ORR	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
ORR - DAC	Exchange	Outlook	1	0	1	3	2	0	1	1	1	10	1	**10**
ORR - HAZ	First Class	First Class	1	1	1	0	3	1	1	1	1	10	1	**10**
NCCOS HQ	Notes	Notes	1	1	1	3	2	1	1	1	1	12	1	**12**
CCEHBR	cc:Mail	cc:Mail	0	1	0	1	1	1	1	1	0	6	0	0
CCFHR	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
CCFHR	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
CCFHR - Ox	Banyan	Blue	0	0	0	0	1	0	1	0	0	2	0	0
GLERL	Sendmail	Eudora	1	1	0	3	3	0	1	1	1	11	1	**11**
GLERL	Sendmail	Netscape	1	1	0	3	3	1	1	1	1	12	1	**12**
GLERL	Sendmail	IE	1	1	1	1	1	1	1	1	1	9	1	**9**
GLERL	Sendmail	elm	1	0	0	0	1	0	1	0	0	3	1	3
* A score of 1 was awarded for each feature supported by the current system. The Preliminary Score is the sum of these feature scores														
The Final Score is the product of the Preliminary Score and the Orginzation Replacement factor (1=keep for interim period, 0=replace soon)														

Appendix D. NOS E-mail Baseline Characterization

NOS E-mail Technology Assessment

					Technical Merit					
Servers		**Feature Set**						**Preliminary Score**	**Org Replace?**	**Final Score**
Office	***Post Office***	*Life cycle*	*Native SMTP*	*IMAP4*	*POP3*	*Dirsynch-auto*	*Local Dir*			
AA/MB	Banyan	0	0	0	0	1	1	2	0	0
MB/IPO	Quarterdeck	0	1	0	1	0	1	3	0	0
CSC	Worldmail	1	1	1	1	0	1	5	0	0
CO-OPS	HP Unixmail	1	1	0	1	0	0	3	1	**3**
CO-OPS	Digital Open	0	1	0	0	0	0	1	0	0
SPO	cc:Mail	0	0	1	1	0	1	3	0	0
NGS	Sendmail	1	1	0	1	0	0	3	1	**3**
OCS	Banyan	0	0	0	0	1	1	2	0	0
OCRM	Banyan	0	0	0	0	1	1	2	0	0
OCRM	Quarterdeck	0	1	0	1	0	1	3	0	0
ORR	Banyan	0	0	0	0	1	1	2	0	0
ORR - DAC	Exchange	1	1	1	1	0	1	5	1	**5**
ORR - HAZ	First Class	1	1	0	0	0	1	3	1	3
NCCOS HQ	Notes	1	1	1	1	0	1	5	1	**5**
CCEHBR	cc:Mail	0	0	0	0	1	1	2	0	0
CCFHR	Banyan	0	0	0	0	1	1	2	0	0
GLERL	HP sendmail	1	1	1	1	0	0	4	1	**4**

* A score of 1 was awarded for each feature supported by the current system. The Preliminary Score is the sum of these feature scores

The Final Score is the product of the Preliminary Score and the Org Replacement factor (1=keep for interim period, 0=replace soon)

Appendix D. NOS E-mail Baseline Characterization

NOS E-mail Systems
June 1998